

## ANTIMICROBIAL ELECTROSPUN MEMBRANES OF SELP/Ag COMPOSITES

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### ABSTRACT

Silk-elastin-like proteins (SELPs) are a new class of bioinspired, biologically synthesized block copolymers, composed of silk and elastin repeating units. SELP electrospun fibre mats show potential for application as wound dressings for skin regeneration. In this work, antimicrobial nanofibrous mats were produced by electrospinning SELP solutions containing different concentrations of silver nitrate without addition of reducing agents. The SELP/Ag composite materials demonstrated antimicrobial activity against both Gram– and Gram+ bacteria. Furthermore, the SELP/Ag composite materials showed no cytotoxicity against normal human skin fibroblasts.

### INTRODUCTION

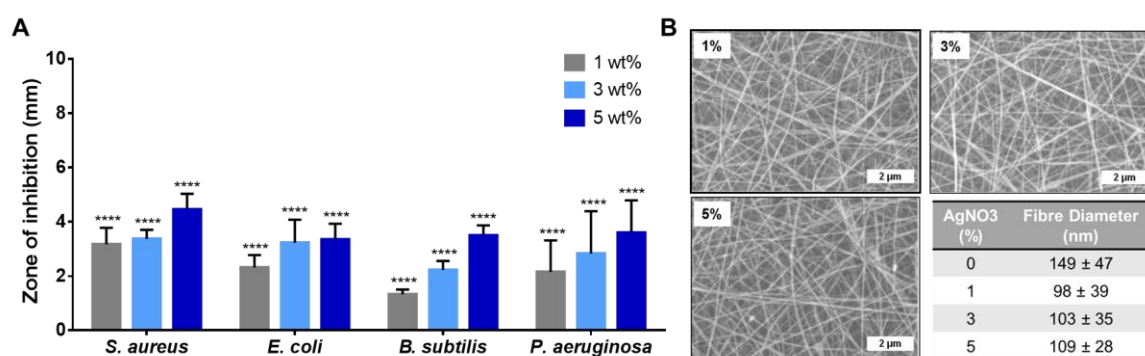
Advances in protein engineering combined with the use of recombinant DNA technology allow the design and production of recombinant Protein-Based Polymers (rPBPs) with an absolute control over its composition, sequence and length. This new class of protein-based materials, inspired in nature and with precisely controlled amino acid sequences, mimic the properties of their natural counterparts but can also display in the same polypeptide chain the properties of two or more different proteins. The silk-elastin-like proteins (SELPs) are a class of rPBPs which composition is based on silk and elastin repeating units, combining in the same polypeptide chain the outstanding mechanical and biological properties of both proteins (Machado, 2013a). As base materials for biomedical purposes, SELP nanofibre mats demonstrate potential to be applied as wound dressing materials for skin regeneration applications (Machado, 2013b). The increasing antimicrobial resistance associated with the excessive and inappropriate use of antibiotics demands the research for new pathogen-free healthcare polymeric materials. In this regard, silver (Ag) is a metal with well-known antimicrobial activity against a broad spectrum of microorganisms (Prabhu, 2012).

### RESULTS AND CONCLUSIONS

In the present work, we report the fabrication of SELP/Ag antimicrobial nanofibrous materials by electrospinning. Pure lyophilized SELP copolymer was dissolved in formic acid with AgNO<sub>3</sub> at different concentrations (1, 3, 5 wt%) without addition of any further agents. As the electrospun mats are highly water soluble, water insolubility and thus structure

stabilization were rendered by exposure to methanol-saturated air. FTIR analysis of the methanol-treated samples demonstrated that water insolubility is mediated through a  $\beta$ -sheet conformation-driven mechanism. Morphological characterization of the electrospun fibres by scanning electron microscopy revealed non-defective fibres with diameters around 100 nm. The antimicrobial performance of the SELP/Ag materials was evaluated by halo inhibition assays against Gram- (*Escherichia coli* and *Pseudomonas aeruginosa*) and Gram+ bacteria (*Bacillus subtilis* and *Staphylococcus aureus*) showing to be effective against all the bacteria tested (Figure 1). Viability of normal human skin fibroblasts (BJ-5ta telomerase immortalized cell line) in the SELP/Ag materials was evaluated *in vitro* demonstrating that these materials do not show significant cytotoxicity.

These results thus suggest that SELP/Ag nanocomposite materials can be used as effective inhibitors of microorganism growth, making them promising materials as biomedical devices such as wound dressings.



**Figure 1.** A) Bar chart representing the antimicrobial performance of SELP/Ag composites against different bacterial species as determined by halo inhibition assays. B) Micrographs of electrospun SELP/Ag composites.

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